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TA058

50 MHz ±70 V differential probe

User's Manual

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1. Description

By enabling conventional oscilloscopes to display and measure in-circuit waveforms that are referenced to high common-mode voltages, this differential probe extends the measurement capability of oscilloscopes to electronic power converters, inverters, motor speed controls, switch-mode power supplies and many other applications.

2. Safety

To prevent possible electrical shock, fire, personal injury or damage to the product, carefully read this safety information before attempting to install or use the product. In addition, follow all generally accepted safety practices and procedures for working with and around electricity.

The product has been designed and tested in accordance with the European standard publication EN 61010-031, pollution degree 2, and left the factory in a safe condition.

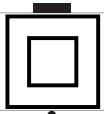
The following safety descriptions are found throughout this guide:

A **WARNING** identifies conditions or practices that could result in injury or death.

A **CAUTION** identifies conditions or practices that could result in damage to the product or equipment to which it is connected.

Symbols

These safety and electrical symbols may appear on the product or in this guide.

Symbol	Description
	Earth (ground) terminal
	Equipment protected through double or reinforced insulation
	Possibility of electric shock
	Caution. Appearance on the product indicates a need to read these safety and operation instructions.
	Do not dispose of this product as unsorted municipal waste

WARNING
To prevent injury or death, use the product only as instructed. Protection provided by the product may be impaired if used in a manner not specified by the manufacturer.

Maximum input ranges

Observe all terminal ratings and warnings marked on the product.

WARNING
To avoid any injury, do not use the probe when the voltage between either input lead and earth is above 600 V RMS.

WARNING
Signals exceeding the voltage limits in the table below are defined as "hazardous live" by EN 61010. To prevent electric shock, take all necessary precautions when working on equipment where hazardous live voltages may be present.

Signal voltage limits of EN 61010-031		
±60 V DC	30 V AC RMS	±42.4 V pk max.

WARNING
To prevent injury or death, the probe must not be directly connected to the mains (line power).

CAUTION
Operation outside of the safe voltage range is likely to cause permanent damage to the product and other connected equipment.

WARNING
The applicable measurement category of a combination of a probe assembly and an accessory is the lower of the measurement categories of the probe assembly and the accessory.

Grounding

This probe is grounded with the shell of the BNC connector and an auxiliary grounding terminal.

WARNING
Before making connections to the input leads of this probe, ensure that its output lead is grounded. You may do this either by connecting the BNC shell to a grounded measurement instrument, or by connecting the auxiliary grounding terminal to a reliable ground point.

You must verify that the probe is securely grounded before connecting the probe input leads. Some types of measuring instrument, such as a USB oscilloscope connected to a laptop, are unlikely to be grounded even if the laptop is powered from the mains. Bench-top oscilloscopes are usually grounded, but in some cases may have been isolated from ground. A USB oscilloscope connected to a desktop computer is usually grounded. In any case, do not assume that the measurement instrument is grounded. Always verify the ground connection before connecting the probe input leads.

External connections

WARNING
To prevent injury or death, only use the power cord and adaptor supplied with the product. These are approved for the voltage and plug configuration in your country.

WARNING
To prevent electric shock, do not touch exposed connections and components when power is present.

CAUTION
Take care to avoid mechanical stress or tight bend radii for all connected leads. Mishandling will cause deformation of sidewalls, and will degrade performance and measurement accuracy.

Environment

WARNING
To prevent injury or death, do not use in wet or damp conditions, or near explosive gas or vapor.

WARNING
To avoid injury or death, always remove jewellery such as rings, watches and other metallic objects.

CAUTION
To prevent damage, always use and store your probe in appropriate environments:

Temperature	–10 to 40 °C (operating) –30 to 70 °C (storage)
Humidity (non-condensing)	25 to 85 %RH (operating and storage)
Altitude	2000 m
Pollution	Degree 2

Care of the product

The product contains no user-serviceable parts. Repair, servicing and calibration require specialized test equipment and must only be performed by Pico Technology or an approved service provider. There may be a charge for these services unless covered by the Pico one-year warranty.

WARNING
To prevent injury or death, do not use the product if it appears to be damaged in any way, and stop use immediately if you are concerned by any abnormal operations.

WARNING
To prevent injury or death, do not operate this probe with the covers removed.

CAUTION
Do not tamper with or disassemble the probe or its accessories. Internal damage will affect performance.

Inspect the probe and all connectors, cables and accessories before use for signs of damage.

3. Installation

Follow these instructions to install and start using your differential probe:

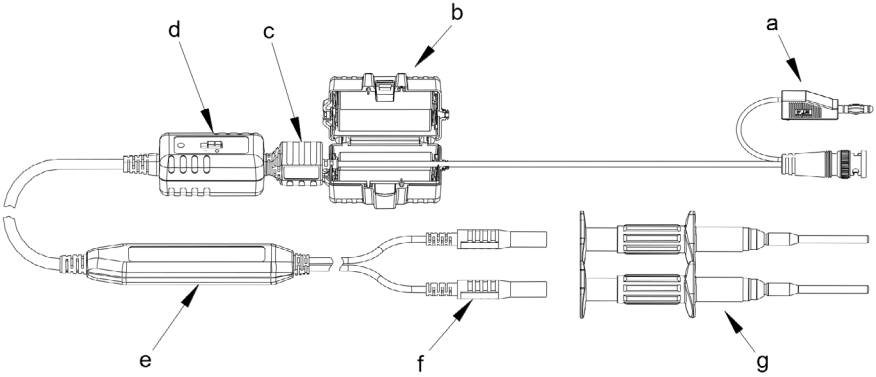
1. Plug in the BNC output connector to the vertical input of a general-purpose oscilloscope or other measurement instrument.
2. Connect the probe to an appropriate power source: USB or external battery pack.
3. Switch the probe ON.
4. Connect the input to the circuit under test.

WARNING
To protect against electric shock, use only the accessories designed for use with this differential probe.

WARNING
To avoid injury or death, you must observe all safety precautions appropriate to the circuit under test.

4. Appearance

A line drawing of the TA058 differential probe is shown below:



a. Output cable:

   The BNC output connector and an auxiliary grounding terminal are connected to the oscilloscope.

b. TA047 removable battery pack (optional): 4 x AA cells

c. Power source connector. Accepts the following inputs:

   - removable battery pack (4 x AA cells)
   - TA531 power lead (USB to DC jack)

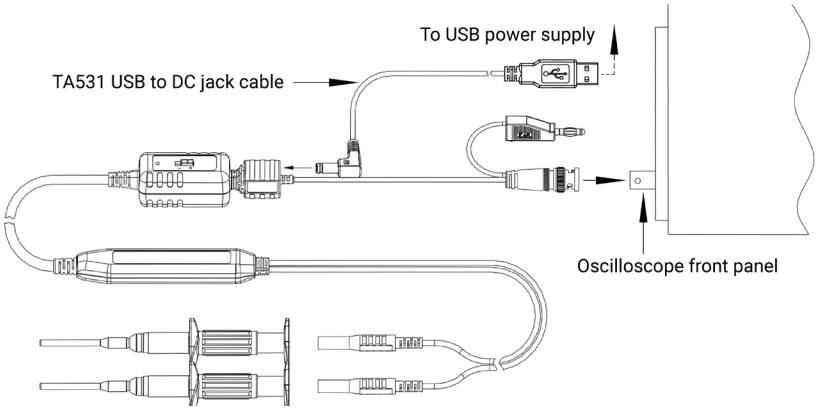
d. Power switch box

e. Probe body

f. Differential probe input leads

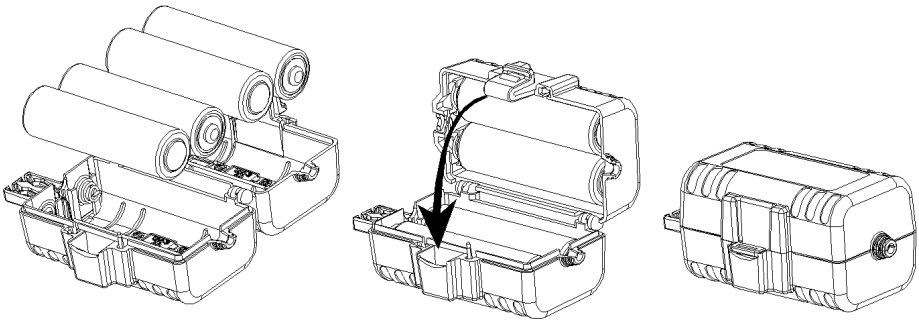
g. Sprung hook connectors

5. Power lead - TA531 USB to DC jack cable



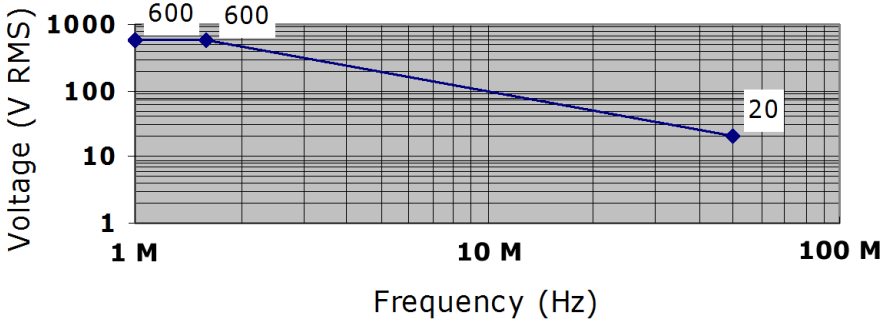
6. TA047 removable battery pack

The TA058 probe can be powered from an optional removable battery pack, which can be connected to the power source connector. The following figures illustrate how to operate the battery pack.



7. Derating curve

The derating curves for absolute maximum input voltage is shown below:



8. Test procedure

1. Connect the BNC output connector to the vertical input of an oscilloscope.
2. Connect to an appropriate power source to the probe and then turn it on.
3. Set the oscilloscope input coupling to DC and 1 V/div. Center the trace on the display.
4. Connect the probe to a known good, safe voltage and verify that the probe measures correctly. A probe calibration pin could be used for this.

9. Calibration of the unit

There are three main sources of uncertainty when calibrating a Pico differential probe in addition to any uncertainty in the test setup. These are:

1. The stated DC accuracy of the probe under test (±1%).
2. Any DC offset or noise in the probe output. The values in this manual are typical. To find the DC offset for a given unit, a reading must be taken after temporarily connecting the two probe inputs together.
3. The AC performance of the probe. This is specified as being within 3 dB over the entire frequency range of the probe. Any absolute voltage accuracy testing must be done under DC conditions.

One other possible source of noise is the power source for the probe. It is recommended that where possible the probes are calibrated using a battery supply rather than a mains supply unit.

10. Cleaning

Use a soft cloth to clean the probe, taking care not to cause damage.

a. Do not immerse the probe.

b. Do not use abrasive cleaners.

c. Do not use chemicals that contain benzene or similar solvents.

11. Specifications

Bandwidth	DC to 50 MHz (−3 dB)
Attenuation ratio	1:10
DC accuracy	±1%
Rise time	< 7 ns
Input impedance	1.6 MΩ ‖ 7 pF each side to ground
Input voltage	
Differential range	±70 V (DC + Peak AC)
Common mode range[1]	±700 V (DC + Peak AC) or 600 V RMS
Absolute max. voltage[1]	
(either input to ground)	±700 V (DC + Peak AC) or 600 V RMS
Output	
Swing (into 5 kΩ load)	±7 V
Offset (typical)	< ±2 mV
Noise (typical)	0.7 mV RMS
Source impedance (typical)	50 Ω
CMRR (typical)	−95 dB @ 60 Hz; −60 dB @ 1 MHz
Power requirements[2]	
Option 1	Removable battery pack (4 x AA cells)
Option 2	TA531 USB power lead
Length of input leads	50 cm
Length of BNC cable	125 cm
Weight	300 g
Dimensions	111 mm L x 22 mm W x 14 mm H

[1] Voltage limit is the lesser of the DC + Peak AC and RMS values.

[2] AA battery polarity is positive terminal inward, negative terminal outward. A built-in protection circuit protects the probe against incorrect battery insertion.

When the combined AA cell voltage falls below the minimum operating level, the power indicator on the panel will dim and then switch off automatically.

UK global headquarters:

☎ +44 (0) 1480 396 395

✉ sales@picotech.com

Pico Technology
James House
Colmworth Business Park
St. Neots
Cambridgeshire
PE19 8YP
United Kingdom

North America regional office:

☎ +1 800 591 2796

✉ sales@picotech.com

Pico Technology
320 N Glenwood Blvd
Tyler
TX 75702
United States

Germany regional office and EU Authorised Representative:

☎ +49 (0) 5131 907 62 90

✉ info.de@picotech.com

Pico Technology GmbH
Emmericher Str. 60
47533 Kleve
Germany

Asia-Pacific contact:

☎ +86 21 2226-5152

✉ pico.china@picotech.com

www.picotech.com